This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

Society for Public Health Education (SOPHE) White Paper on Applied Approaches to the Social and Behavioral Health Sciences: Response to the National Science Foundation Call for Recommendations on Future Research in the Social, Behavioral & Economic Sciences

William C. Livingood, Ph.D.,[1] John P. Allegrante, Ph.D.,[2] Collins O. Airhihenbuwa, Ph.D., M.P.H.,[3] Noreen M. Clark, Ph.D.,[4] Lawrence W. Green, Dr.P.H.,[5] Richard C. Windsor, Ph.D., M.P.H.,[6] and Marc A. Zimmerman, Ph.D.[7] on behalf of the Society for Public Health Education*

[1]Duval County Health Department Institute for Public Health Informatics and Research, and University of Florida College of Medicine, Jacksonville, FL; and the Jiann-Ping Hsu College of Public Health, Georgia Southern University, Statesboro, GA. [2]Teachers College and the Joseph L. Mailman School of Public Health, Columbia University, New York, NY. [3]Department of Biobehavioral Health, The Pennsylvania State University, University Park, PA. [4]University of Michigan Center for Managing Chronic Disease, Ann Arbor, MI. [5]University of California, San Francisco, CA. [6]The George Washington University School of Public Health and Health Services, Washington, DC. [7]University of Michigan School of Public Health, Ann Arbor, MI

* The Board of Trustees of the Society for Public Health Education ratified this statement on October 13, 2010. All seven authors are Distinguished Fellows of the Society for Public Health Education; six (W.C.L., J.P.A., C.O.A., N.M.C., L.W.G., & R.C.W.) are Past Presidents; three (N.M.C., L.W.G., & M.A.Z.) are Editors-in-Chief Emeriti and one (J.P.A.) is the current Editor-in-Chief of the Society's flagship research journal, *Health Education & Behavior*; and two (N.M.C. & L.W.G.) are members of the Institute of Medicine.

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

Abstract

Complex and dynamic societal and community factors continue to challenge the capacity of social and behavioral health sciences to overcome intractable health problems. The Society for Public Health Education (SOPHE) endorses the strategic vision of the NIH Office of Behavioral and Social Sciences Research to advance the social and behavioral sciences related to these challenges. SOPHE proposes, however, an additional priority to address the challenges: *the development of applied approaches to the social and behavioral health sciences.* The development of applied social and behavioral health sciences would constitute a fundamental change from the predominant science approach, which focuses on research that identifies universally applicable interventions that are then implemented by practitioners. This prevailing linear approach to social and behavioral sciences offers little promise for overcoming the persistent problems facing us today. An applied social and behavioral health sciences approach, similar to applied physical sciences such as engineering, would require a foundational and transformational change in our dichotomy of research and practice. It would also require the development of new disciplines of the science of application that are sensitive to the complexity, interactivity, and uniqueness of community, as well as modification of our health-related professional preparation programs to develop applied scientists.

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

Introduction

Seemingly intractable health problems and the disappointing progress in reducing health disparities continue to challenge the prevailing conventions of the social and behavioral sciences that have sought to improve health. The complexities of interacting social, cultural, political, technical, economic, and ethical factors of community and society are particularly challenging to the predominant approaches to social and behavioral health sciences. The National Institutes of Health (NIH) Office of Behavioral and Social Science Research (OBSSR) provides a strategic vision for advancing research to address many of the challenges associated with such complexities (Mabry et al., 2008).

While the Society for Public Health Education (SOPHE), whose mission is to provide global leadership to the profession of health education and health promotion, and to promote the health of society, supports the OBSSR vision, it recommends an additional priority to address these challenges: *the development of applied approaches to the social and behavioral health sciences*. We make this recommendation because we agree with OBSSR that

> "…the simple, single-cause, single-discipline, and now, even single-level-of-analysis models—whether predominantly biomedical or predominantly behavioral or social-ecologic—are increasingly viewed as necessary but insufficient. This is especially true for the common, most preventable, and most expensive chronic diseases that afflict the vast majority of populations in the developed nations of the world and that cry out for research to provide a more timely understanding of basic mechanisms, better interventions, and more science-informed health policy." (Mabry et al., 2008, p. S223)

OBSSR's conclusion that "… the solutions to the most vexing public health problems are likely to be those that embrace the behavioral and social sciences as key players" (Mabry et al., 2008, p. S212) is fundamental to achieving societal progress in addressing the major health problems that now constitute the leading causes of morbidity and mortality, both in the United States and, increasingly, globally. Although NIH has funded some behavioral research, it has funded little of the social and behavioral sciences research that promises to yield break-through advances.

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

OBSSR's recommended priorities for social and behavioral sciences research include continued development of the sciences related to:

1. Gene-environment interactions;
2. Environmental effects on physiology;
3. Application of technology;
4. Measurement, and methodology in social and behavioral science;
5. Social integration and social capital;
6. Complex adaptive systems; and
7. Social movements and policy change.

Each of these areas of scientific inquiry will require much greater investment in methods and approaches to be responsive to the future research needs of the nation, such as the transdisciplinary research paradigm that has been recommended in OBSSR's strategic vision. We also commend NIH for increasing its support for translational research, including dissemination and implementation research, and its plans to include studies of patient subsets with multiple comorbidities in Comparative Effectiveness Research sponsored by the Patient-Centered Outcomes Research Institutes. These efforts are shifting resources for research to applied science or to address more complex biomedical issues. They offer promising directions within the context of linear-science applications. But the increased interest in applied science and complexity tends to apply single, highly-defined, and evidence-based interventions that have been tested in one setting or population to other settings and populations, thus reinforcing and reifying the prevailing linear and universally generalizable approaches to science that dominate our thinking but which continue to fail society. We believe that social and behavioral research whose purpose is to promote human health needs fundamental change beyond the current approaches, which merely attempt to find solutions through research that is then expected to be faithfully applied by practitioners.

The Need for New Science

The evolution of social and behavioral sciences does not reflect the evolution of philosophy and practice of some of the physical sciences, particularly related to complexity and application. Engineering

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

is a case in point. The single-cause research that NIH has transferred to social and behavioral health research from its biomedical science tradition, which has sought universal or highly generalizable results, remains the dominant paradigm, particularly among the major research-funding organizations. This reliance on traditional linear-science approaches has also resulted in a false dichotomy of research and practice, with profound implications for education, training, and professional preparation of research scientists and practitioners.

The need for scientific approaches that address the dynamic complexity of community and society is illustrated by the inherent challenges to science experienced in what is often referred to as one of the greatest public health accomplishments of the 20th century: the reversal of the tobacco epidemic, which started in the mid-1960s, when the first Surgeon General's Report on Smoking and Health documented the potential health hazards of smoking. The remarkable cultural transformation from a social obligation to accept and even enable tobacco use to that of social intolerance of tobacco in many, and now most, public settings, is somehow lost with the numerous reports on tobacco research and syntheses of the available evidence, which treat only randomized, mostly individual, behavioral interventions as worthy of inclusion in their reviews. Tobacco cessation programs easily qualified for such intervention science because individuals can be more readily assigned randomly to experimental treatment and control groups. Community-wide interventions and policy changes, on the other hand, are less likely to be represented in such funding and reviews because of the difficulty of random assignment, despite growing consensus by most experts that these interventions were largely responsible for turning the tobacco epidemic around.

Although the reversals in tobacco use following the anti-tobacco health promotion counter-advertising, media campaigns, tax increases, and policy changes are well known and have been documented, we are left with a preponderance of literature reporting on the clinically-based tobacco-cessation interventions as providing the scientific evidence for what works. The prevailing linear science points us away from what is most likely to have produced the major cultural changes leading to denormalization of tobacco and social intolerance of smoking. The media-based health education and

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

promotion programs, and local community mobilization and advocacy for smoke-free environments that followed and are conceded to have had profound impact, are scarcely represented in most compilations and systematic reviews of the published scientific evidence for what works to reduce tobacco use. The conclusions that the only interventions for which there is "scientific evidence" (using the criteria of theory-based, hypothesis-testing, randomized controlled trials) are cessation programs not only ignore what actually produced one of the greatest public health accomplishments of the 20th century, they perversely points us in the direction of high-cost medical interventions (i.e., clinically-based, individually-delivered smoking cessation programs). Such interventions are not only relatively expensive and probably had little to do with the major social transformation in tobacco reduction, but because of the potential for reduced access caused by high cost, they can potentially increase rather than reduce disparities and costs.

The need for more socially- and economically-based approaches to research on health recognizes the social and cultural contexts that influence human behaviors. The critical role of social determinants in influencing health is also increasingly recognized in virtually every sector, both in the United States and throughout the advanced economies of the world. Yet, the varied and complex interactions of social context are rarely recognized with the scientific approaches long favored by NIH peer review processes. Community structural and functional characteristics cannot be expected to be as homogeneous as human anatomy and physiology. Consequently, the research techniques associated with highly similar and possibly generalizable and predictable research results are simply not applicable to the varied and complex interactivity associated with community and society. There is too little similarity in structure, culture, politics, economics, and function of communities and their populations that would suggest that a randomized controlled trial in one or more of them could produce highly generalizable results. Unlike the uses of pharmacological products in the treatment of human diseases, the similar testing of social, behavioral, or economic interventions would not be applicable to their generalization or to taking such a tested intervention to scale.

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

The evolution of the philosophy of science reflected in quantum physics and fluid mechanics represents scientific approaches that are much more responsive to physical characteristics that involve complexity and uniqueness, in contrast to Baconian and Newtonian science that emphasizes laws of nature with predictability and generalizability (Prigogine, 1996). These approaches to science, which focus on unique complex interactions, provide more applicable models to the study of society and community. While highly reliant on mathematical modeling, these approaches can also have highly practical trial-and-error approaches such as the use of wind tunnels to design airplane wings (Gleick, 2008). While we commend the use of mathematical modeling associated with systems science and public health as recommended in the OBSSR strategic vision, we also see the need for applied science that is reflected in engineering and architecture. Our current approach to social and behavioral sciences for the testing of population-wide solutions in health is much more aligned with the goals and approaches of biomedical science than engineering, which can be seen contrasted in Table 1.

Adopting an applied-science approach to the social and behavioral sciences in health has important implications for how we prepare our researchers and practitioners, whose training is dichotomized within our current approach to science. Engineering does not so blatantly dichotomize research and practice as does the current biomedical approach to behavioral and social sciences in health. Applied science such as engineering adapts many scientific principles and methods to each unique situation. Engineers might test the strength of certain materials under the local conditions before selecting the materials, but each structure or other intervention is customized to the setting, based primarily on the unique characteristics of each setting. The applied-science approach requires rigorous, sophisticated, and extensive training in analyzing the existing conditions and developing a solution unique to the specific setting. These applied sciences have developed into unique areas of scientific inquiry, focused on unique application rather than generalizable theory.

Applied social and behavioral sciences related to public health require a more radical departure from research methods and principles focused on individual change. Rather than practitioners who apply the discoveries of science, we need applied scientists who are able to apply numerous scientific principles

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

to each unique community, spanning both research and practice. This applied science needs to be developed and researched in the same manner that the disciplines of engineering and architecture are studied and developed.

The evolution of the profession of health education and health promotion has taken on many of these characteristics of applied science. The Health Education Role Delineation Project and the adoption of responsibilities and competencies for individual credentialing and professional preparation that followed, has advanced the health education and promotion training to focus on much more of an applied science that includes assessment, planning and evaluation—similar to engineering. The use of logic models for health education, health promotion and communication, for example, has at least partial origins in the science of engineering.

The term, "behavioral engineering," has many negative implications, particularly the limits on choice and free will that are anathema to our culture, and consequently should be avoided. However, we have not made adequate progress in addressing health disparities. A scientific approach that promises to yield better results is needed. What is clearly missing in health promotion, public health, and even much of medical practice is applied research that is more typical of engineering or architecture. The focus of these applied sciences is on local application rather than universal solutions or applications.

Conclusion

Continued pursuit of the same approaches to enhancing the social and behavioral aspects of public health will produce results with little generalizability, even though that is their professed hallmark and purpose. We recommend that the National Science Foundation (NSF) and other private and public scientific communities support the development and implementation of a more robust applied science approach to social and behavioral factors in public health. The priorities for supporting such applied science and the pipeline by which a new generation of scientists can be trained should be pursued by NSF in conjunction with other federal agencies, particularly NIH, the Centers for Disease Control, and the Agency for Healthcare Research and Quality.

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

Table 1

Comparison of Key Attributes of Engineering and the Biomedical and Behavioral and Social Sciences

Engineering	Biomedical and Behavioral and Social Sciences
Applied research on problem solution	Research to identify generalizable truths/laws
Adapt to existing conditions/variables	Control of all but experimental variables
Real life, community setting	Laboratory conditions – actual or simulated
Immediate/local problem-solving	Generalizable findings universally applicable
Perceived to be very rigorous & scientific (even at undergraduate level)	Requires graduate training for recognized contributions & problem-solving

This paper was submitted to the National Science Foundation as part of its SBE 2020 planning activity (www.nsf.gov/sbe/sbe_2020/). Its inclusion does not constitute approval of the content by NSF or the US Government. The opinions and views expressed herein are those of the author(s) and do not necessarily reflect those of the NSF or the US Government.

References[1]

Gleick, J. (2008). *Chaos: Making a new science*. New York: Penguin Books.

Mabry, P.L., Olster, D.H., Morgan, G.D., & Abrams, D.B. (2008). Interdisciplinarity and systems science to improve population health: A view from the NIH Office of Behavioral and Social Sciences Research. *American Journal of Preventive Medicine, 35*(2 Suppl), S211-224.

Prigogine, I. (1996). *The end of certainty: Time, chaos, and the new laws of nature.* New York: The Free Press.

This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-sa/3.0/ or send a letter to Creative Commons, 171 Second Street, Suite 300, San Francisco, California, 94105, USA.

[1] A bibliography of additional references and other documents that were utilized in preparing this statement are available upon request.